CLAIMS

What is claimed is:

1. A polymeric pigment dispersant having improved stability in a pigment dispersion for achieving efficient wetting and grinding of a pigment in the pigment dispersion, said polymeric pigment dispersant comprising the reaction product of:

a first compound having a plurality of first hydroxyl groups;

a carboxylic acid anhydride reactive with said first hydroxyl groups to form a carboxylate group;

a second compound having at least one epoxy group reactive with said carboxylate group to form a second hydroxyl group;

an amine reactive with said carboxylate group to form an acid anion group for salting the carboxylate group; and

an acid for controlling a pH of the polymeric pigment dispersant such that the polymeric pigment dispersant has improved stability in the pigment dispersion in response to the modification of said pH.

2. A polymeric pigment dispersant as set forth in claim 1 wherein said acid is further defined as an acid having at least two functional acid groups for reacting with at least one of said first and said second hydroxyl groups such that said acid improves the stability of the pigment dispersion.

3. A polymeric pigment dispersant as set forth in claim 2 wherein said acid is polyphosphoric acid having three functional acid groups for reacting with at least one of said first and said second hydroxyl groups.

4. A polymeric pigment dispersant as set forth in claim 3 wherein said acid is present in an amount from 0.5 to 10 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

5. A polymeric pigment dispersant as set forth in claim 4 wherein said first compound is dipentaerythritol and wherein said first plurality hydroxyl groups is further defined as six hydroxyl groups for reacting with at least one of said carboxylic acid anhydride and said acid.

6. A polymeric pigment dispersant as set forth in claim 5 including a pH from about 7 to about 12 for improving the stability of the dispersant.

7. A polymeric pigment dispersant as set forth in claim 5 including a pH from about 7 to about 10 for improving the stability of the dispersant.

8. A polymeric pigment dispersant as set forth in claim 5 including a pH from about 7.3 to about 8.5 for improving the stability of the dispersant.

9. A polymeric pigment dispersant as set forth in claim 1 wherein the molar ratio of said carboxylic acid anhydride to said first compound is from 2:1 to 20:1.

10. A polymeric pigment dispersant as set forth in claim 2 wherein said acid is selected from the group consisting of polyphosphoric acid, sulfuric acid, sulfurous acid, dicarboxylic acids, and mixtures thereof.

11. A polymeric pigment dispersant as set forth in claim 10 wherein said acid is present in an amount from 0.5 to 10 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

12. A polymeric pigment dispersant as set forth in claim 11 wherein said first compound is dipentaerythritol and wherein said first plurality hydroxyl groups is further defined as six hydroxyl groups for reacting with at least one of said carboxylic acid anhydride and said acid.

13. A polymeric pigment dispersant as set forth in claim 12 wherein the molar ratio of said carboxylic acid anhydride to said dipentaerythritol is from 2:1 to 6:1.

14. A polymeric pigment dispersant as set forth in claim 13 wherein the molar ratio of said carboxylic acid anhydride to said dipentaerythritol is 5:1 and said polymeric pigment dispersant has a molecular weight of from about 1300 to about 2000.

15. A polymeric pigment dispersant as set forth in claim 13 wherein the molar ratio of said carboxylic acid anhydride to said dipentaerythritol is 3:1 and said polymeric pigment dispersant has a molecular weight of from about 800 to about 1200.

16. A polymeric pigment dispersant as set forth in claim 1 wherein said first compound is selected from the group consisting of erythritol, pentaerythritol, dipentaerythritol, trimethylolethane, trimethylolpropane, dulcitol, threitol, and mixtures thereof.

17. A polymeric pigment dispersant as set forth in claim 16 wherein said first compound is present in an amount from 1 to 20 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

18. A polymeric pigment dispersant as set forth in claim 1 wherein said carboxylic acid anhydride is selected from the group consisting of maleic anhydride, hexahydrophthalic anhydride, methyl-hexahydrophthalic anhydride, tetrahydrophthalic anhydride, phthalic anhydride, succinic anhydride, dodecenylsuccinic anhydride, trimellitic anhydride, and mixtures thereof.

19. A polymeric pigment dispersant as set forth in claim 18 wherein said carboxylic acid anhydride is present in an amount from 15 to 45 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

20. A polymeric pigment dispersant as set forth in claim 1 wherein said second compound has from 6 to 20 carbon atoms.

21. A polymeric pigment dispersant as set forth in claim 20 wherein said second compound is selected from the group consisting of glycidylneodecanoate,

dodecyl oxide, tetradecyl oxide, octadecyl oxide, cyclohexene oxide, and mixtures thereof.

22. A polymeric pigment dispersant as set forth in claim 21 wherein said second compound is present in an amount from 7 to 25 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

23. A polymeric pigment dispersant as set forth in claim 1 wherein said amine is selected from the group consisting of dimethylethanolamine, amino methyl propanol, and mixtures thereof.

24. A polymeric pigment dispersant as set forth in claim 23 wherein the molar ratio of said amine to said second compound is from 1:1 to 20:1.

25. A polymeric pigment dispersant as set forth in claim 24 wherein said amine is present in an amount from 5 to 35 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

26. A polymeric pigment dispersant as set forth in claim 1 having a molecular weight of 3000 or less.

27. A polymeric pigment dispersant as set forth in claim 1 having a non-volatile content of from 45 to 65 percent non-volatile by weight.

28. A polymeric pigment dispersion having improved stability for use in a coating composition, said polymeric pigment dispersion comprising:

a pigment; and

a polymeric pigment dispersant comprising the reaction product of;

a first compound having a plurality of first hydroxyl groups,

a carboxylic acid anhydride reactive with said hydroxyl groups to form a carboxylate group,

a second compound having at least one epoxy group reactive with said carboxylate group to form a second hydroxyl group,

an amine reactive with said carboxylate group to form an acid anion group for salting the carboxylate group, and

an acid for controlling a pH of the polymeric pigment dispersant such that the polymeric pigment dispersant has improved stability in the pigment dispersion in response to the modification of said pH.

29. A polymeric pigment dispersion as set forth in claim 28 wherein said acid comprises an acid having at least two functional acid groups for reacting with at least one of said first and said second hydroxyl groups such that said acid improves the stability of the pigment dispersion.

30. A polymeric pigment dispersion as set forth in claim 29 wherein said acid is polyphosphoric acid having three functional acid groups for reacting with at least one of said first and said second hydroxyl groups.

31. A polymeric pigment dispersion as set forth in claim 30 wherein said acid is present in an amount from 0.5 to 10 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

32. A polymeric pigment dispersion as set forth in claim 31 wherein said first compound is dipentaerythritol and wherein said first plurality hydroxyl groups includes six hydroxyl groups for reacting with at least one of said carboxylic acid anhydride and said acid.

33. A polymeric pigment dispersion as set forth in claim 32 including a pH from about 7 to about 12 for improving the stability of the dispersant.

34. A polymeric pigment dispersion as set forth in claim 32 including a pH from about 7 to about 10 for improving the stability of the dispersant.

35. A polymeric pigment dispersion as set forth in claim 32 including a pH from about 7.3 to about 8.5 for improving the stability of the dispersant.

36. A polymeric pigment dispersion as set forth in claim 28 including a viscosity differential of from 0 to about 15 wherein said viscosity differential is defined as a difference between an initial viscosity of said pigment dispersion and a viscosity measured after said pigment dispersion is exposed at 110°F for at least 14 days.

37. A polymeric pigment dispersion as set forth in claim 28 wherein said first compound is selected from the group consisting of erythritol, pentaerythritol, dipentaerythritol, trimethylolethane, trimethylolpropane, dulcitol, threitol, and mixtures thereof.

38. A polymeric pigment dispersion as set forth in claim 37 wherein said carboxylic acid anhydride is selected from the group consisting of maleic anhydride, hexahydrophthalic anhydride, methyl-hexahydrophthalic anhydride, tetrahydrophthalic anhydride, phthalic anhydride, succinic anhydride, dodecenylsuccinic anhydride, trimellitic anhydride, and mixtures thereof.

39. A polymeric pigment dispersion as set forth in claim 38 wherein said second compound has from 6 to 20 carbon atoms.

40. A polymeric pigment dispersion as set forth in claim 39 wherein said second compound is selected from the group consisting of glycidylneodecanoate, dodecyl oxide, tetradecyl oxide, octadecyl oxide, and cyclohexene oxide, and mixtures thereof.

41. A polymeric pigment dispersion as set forth in claim 40 wherein said amine is selected from the group consisting of dimethylethanolamine and amino methyl propanol, and mixtures thereof.

42. A polymeric pigment dispersion as set forth in claim 28 wherein said polymeric pigment dispersant has a molecular weight of 3000 or less.

43. A polymeric pigment dispersion as set forth in claim 28 wherein said polymeric pigment dispersant has a non-volatile content of from 45 to 65 percent non-volatile by weight.

44. A method of preparing a polymeric pigment dispersant having improved stability in a pigment dispersion for achieving efficient wetting and grinding of a pigment in the dispersion, said method comprising the steps of:

(i) reacting a first compound having a plurality of first hydroxyl groups with a carboxylic acid anhydride to form an intermediate compound having a plurality of carboxylate groups;

(ii) reacting at least one of the carboxylate groups of the intermediate compound with a second compound having at least one epoxy group to form at least one second hydroxyl group;

(iii) reacting at least one of the other carboxylate groups of the intermediate compound with an amine; and

(iv) reacting an acid with at least one of the first and the second hydroxyl groups for improving the stability of the pigment dispersion.

45. A method as set forth in claim 44 wherein the steps of (i) reacting the first compound with the carboxylic acid anhydride, (ii) reacting at least one of the carboxylate groups of the intermediate compound with the second compound, (iii) reacting the other of the carboxylate groups of the intermediate compound with the amine, and (iv) reacting an acid with at least one of the first and the second hydroxyl groups are conducted at a temperature between 50°C and 200°C.

46. A method as set forth in claim 44 wherein the step of reacting the acid is further defined as reacting an acid having at least two functional acid groups for reacting with at least one of the first and the second hydroxyl groups such that the acid improves the stability of the pigment dispersion.

47. A method as set forth in claim 44 wherein the step of reacting the acid is further defined as the step of reacting polyphosphoric acid having three functional acid groups for reacting with at least one of said first and said second hydroxyl groups.

48. A method as set forth in claim 44 wherein the first compound is selected from the group consisting of erythritol, pentaerythritol, dipentaerythritol, trimethylolethane, trimethylolpropane, dulcitol, threitol, and mixtures thereof.

49. A method as set forth in claim 48 wherein the first compound is dipentaerythritol.

50. A method as set forth in claim 44 wherein the carboxylic acid anhydride is selected from the group consisting of maleic anhydride, hexahydrophthalic anhydride, methyl-hexahydrophthalic anhydride, tetrahydrophthalic anhydride, phthalic anhydride, succinic anhydride, dodecenylsuccinic anhydride, trimellitic anhydride, and mixtures thereof.

51. A method as set forth in claim 50 wherein the carboxylic acid anhydride is hexahydrophthalic anhydride.

52. A method as set forth in claim 44 wherein the second compound is selected from the group consisting of glycidylneodecanoate, dodecyl oxide, tetradecyl oxide, octadecyl oxide, and cyclohexene oxide, and mixtures thereof.

53. A method as set forth in claim 52 wherein the second compound is glycidylneodecanoate.

54. A method as set forth in claim 44 wherein the amine is selected from the group consisting of dimethylethanolamine and amino methyl propanol, and mixtures thereof.

55. A method as set forth in claim 54 wherein the amine is dimethylethanolamine.

56. A method as set forth in claim 44 wherein the step of reacting the first compound with the carboxylic acid anhydride is further defined as reacting one mole of dipentaerythritol with three moles of hexahydrophthalic anhydride to form the intermediate compound having three carboxylate groups.

57. A method as set forth in claim 56 wherein the step of reacting at least one of the carboxylate groups of the intermediate compound with the second compound is further defined as reacting one of the three carboxylate groups of the intermediate compound with one moles of glycidylneodecanoate.

58. A method as set forth in claim 57 wherein the step of reacting the other of the carboxylate groups of the intermediate compound with the amine is further

defined as reacting the remaining two of the three carboxylate groups of the intermediate compound with two moles of dimethylethanolamine.

59. A coating composition comprising:

a resin;

a cross-linking agent reactive with said resin; and

a pigment dispersion comprising;

a pigment, and

a polymeric pigment dispersant, said polymeric pigment dispersant comprising the reaction product of,

a first compound having a plurality of first hydroxyl groups,

a carboxylic acid anhydride reactive with said first hydroxyl groups to form a carboxylate group,

a second compound having at least one epoxy group reactive with said carboxylate group to form a second hydroxyl group,

an amine reactive with said carboxylate group to form an acid anion group for salting the carboxylate group, and

an acid for controlling a pH of the polymeric pigment dispersant such that the polymeric pigment dispersant has improved stability in the pigment is persion in response to the modification of said pH and wherein said pigment dispersant has improved compatibility with said resin.

60. A coating composition as set forth in claim 59 wherein said acid is further defined as an acid having at least two functional acid groups for reacting with at least one of said first and said second hydroxyl groups such that said acid improves the stability of the pigment dispersion.

61. A coating composition as set forth in claim 60 wherein said acid is polyphosphoric acid having three functional acid groups for reacting with at least one of said first and said second hydroxyl groups.

62. A coating composition as set forth in claim 61 wherein said acid is present in an amount from 0.5 to 10 parts by weight based on 100 parts by weight of the polymeric pigment dispersant.

63. A coating composition as set forth in claim 62 wherein said polymeric pigment dispersion of the coating composition has a pH from about 7 to about 12 for improving the stability of the dispersant.

64. A coating composition as set forth in claim 62 wherein said polymeric pigment dispersion of the coating composition has a pH from about 7 to about 10 for improving the stability of the dispersant.

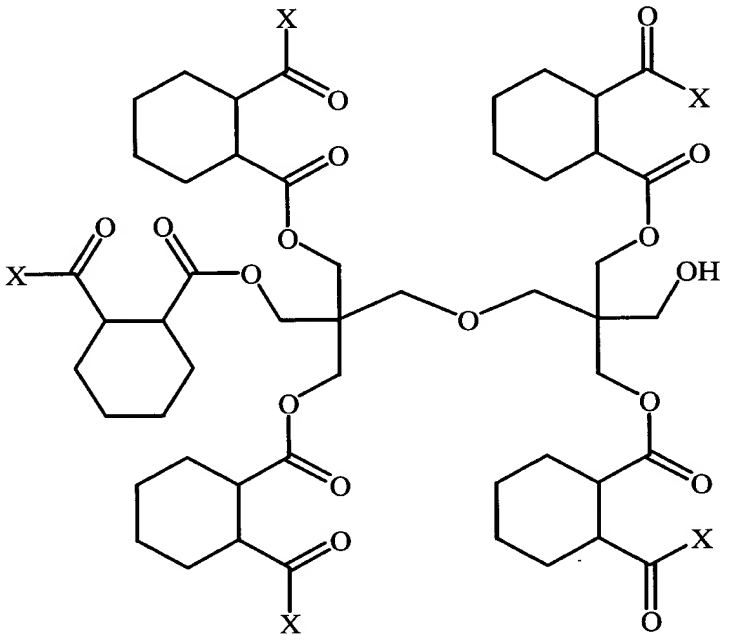
65. A coating composition as set forth in claim 62 wherein said polymeric pigment dispersion of the coating composition has a pH from about 7.3 to about 8.5 for improving the stability of the dispersant.

66. A coating composition as set forth in claim 62 wherein said first compound is dipentaerythritol and wherein said first plurality hydroxyl groups includes six hydroxyl groups for reacting with at least one of said carboxylic acid anhydride and said acid.

67. A coating composition as set forth in claim 66 selected from the group consisting of waterborne basecoats, waterborne clearcoats, waterborne primer surfacers, and mixtures thereof.

68. A coating composition as set forth in claim 66 wherein said resin is selected from the group consisting of acrylic resins, alkyd resins, polyurethane resins, polyester resins, and mixtures thereof.

69. A polymeric pigment dispersant having improved stability in a pigment dispersion for achieving efficient wetting and grinding of a pigment in the pigment dispersion, said polymeric pigment dispersant being of the general formula:



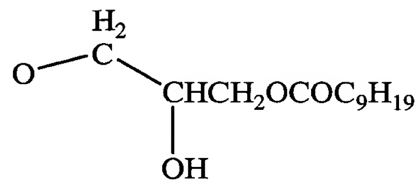
wherein X is selected from the group consisting of;

(i) O^-; and

(ii) R_1;

wherein R_1 is a compound having at least one oxygen atom and from 6 to 20 carbon atoms.

70. A polymeric pigment dispersant as set forth in claim 69 wherein R_1 is further defined as



71. A polymeric pigment dispersant as set forth in claim 69 wherein R_1 is further defined as